Brucellosis and inflammatory markers: data from south-east province of Turkey

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Abstract

Aim: Brucellosis is the most common zoonosis in the world. It is commonly seen in developing countries and causes economic loss. Brucellosis is a major public health problem. Therefore, early diagnosis of brucellosis is very important. The current study aims to investigate WBC, CRP, ESR, NLR, PLR and MPV levels, when brucellosis was first diagnosed. Material and Method: The study included a total of 394 patients who were enrolled at our hospital between the dates of January 2007 and June 2017. Among these patients 197 were cases of brucellosis and 197 were healthy controls. Results: WBC values were statistically significantly lower in the patients with brucellosis, compared to the control group ($p < 0.001$). Otherwise, NLR, CRP, ESR and MPV values were statistically significantly higher in the patients with brucellosis, compared to the control group (<0.001, 0.005, 0.001, 0.042, p values respectively). PLR values did not differ statistically significantly between the groups ($p = 0.468$). Discussion: NLR is obtained from a whole blood count. NLR increases in inflammatory conditions and this increase are regarded as a marker of systemic inflammation. In a study, it was determined that NLR values were significantly higher in the brucellosis group than the control group ($p = 0.032$). Mean platelet volume indicates platelet size and activity. It is also used as a marker of platelet dysfunction. Increased MPV level is associated with thrombotic disorders and endothelial dysfunction. In the study by Aktar et al. MPV values were significantly higher in the brucellosis group than in the control group ($p=0.026$). Conclusion: NLR and MPV have been shown to be important markers that can be used in the first diagnosis of brucellosis.

Keywords

Brucellosis; Inflammatory Markers; NLR; PLR

DOI: 10.4328/JCAM.5906 Received: 27.05.2018 Accepted: 06.06.2018 Published Online: 10.06.2018 Printed: 01.11.2018 J Clin Anal Med 2018;9(6): 578-81
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Introduction

Brucellosis is a zoonotic disease that is transmitted to people from infected animals or dairy product via direct or indirect contact. The disease is common in many parts of the world and as well as in Turkey; and it affects all age groups and both genders. Brucella is a gram-negative bacteria that may involve reticuloendothelial system and many organs. Patients with brucellosis may present non-specific clinical manifestations such as fever, chill, weakness, fatigue, sweating, arthralgia, myalgia, back pain, and headache. In the diagnosis of brucellosis, the gold standard of diagnosis is culture of brucellosis. But commonly, standard agglutination test (SAT) is used for diagnosis of brucellosis. If titer of SAT is 1: 160 or higher, result is accepted positive [1-4].

High C-reactive protein (CRP), and high erythrocyte sedimentation rate (ESR) can be found in patients with brucellosis. But these markers can help us especially in following the disease [5,6].

Complete blood count (CBC) is an easily available test with a low price. The numbers of white blood cells (WBC), neutrophils, lymphocytes and value of mean platelet volume (MPV) are also evaluated in the CBC test; these values and their ratios are used as inflammatory markers. The neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) are several of the most important ones of these markers.

This study aims to investigate WBC, CRP, ESR, NLR, PLR and MPV levels, when brucellosis was first diagnosed.

Material and Method

The study included a total of 394 patients who enrolled at Kahramanmaraş Sütçü İmam University hospital between the dates of January 2007 and June 2017. Among these patients 197 were cases of brucellosis ≥ 18 years of age, and 197 were healthy controls. The groups were similar to each other, regarding age and gender. The study was approved by the local ethics committee (2017/11 date: 05.07.2017, number: 07).

Healthy controls who applied to the hospital for routine check-up, or vaccination status screening. Participants with systemic illness or any sign of infection were excluded from the control group. Equal or higher than titer of SAT 1: 160 or positive blood culture were used for the diagnosis of brucellosis. The age, gender, and outcomes of the laboratory analysis were obtained from patients' folders and hospital records.

The complete blood count (CBC), CRP and ESR were analyzed using the Beckman Coulter LH 750, Beckman Coulter image 800 and Thermo linear devices respectively, according to the guidelines of the producer firms.

Statistical Analysis

The data of the study was evaluated using the SPSS version 17.0 statistical software (SPSS Inc., Chicago, Illinois, USA). The continuous variables were expressed as the mean and standard deviation, and the categorical variables were expressed in numbers and percent values. The student's t-test was used to compare the continuous variables between independent groups. The chi-square (X2) test was used to compare two independent groups regarding the categorical variables. A p-value less than 0.05 was accepted as statistically significant.

Results

The study included total of 394 cases. Fifty percent of these patients (n = 197) were cases with brucellosis and 50% (n = 197) were controls. When the groups were investigated regarding the genders, group with brucellosis included 83 males (42.1%) and 114 females (57.9%), and control group included 77 males (39.1%) and 120 females (60.9 %). Statistically significant differences did not exist between groups, regarding the distribution of genders (X2, p = 0.538). The mean ages in the cases with brucellosis were 49.6 ± 19.1 years and controls were 50.1 ± 16.4 years. The age did not differ statistically significantly between the groups (p = 0.777).

The values of WBC, CRP, ESR, NLR, PLR and, MPV in the brucellosis at admission and control groups are presented in Table 1. Different SAT titer and WBC, CRP, ESR, NLR, PLR and, MPV mean values compared with Pearson correlated test. There was significant negative correlation between WBC and SAT titer (r = (-) 0.237, p < 0.001). There was significant positive correlation between NLR and SAT titer (r = 0.326, p < 0.001). But there was insignificant correlation between PLR and SAT titer (r = 0.025, p = 0.626). Results are presented in Table 2.

Table 1. WBC, CRP, ESR, NLR, PLR and, MPV values in brucellosis and control groups.

	Brucellosis (n:197) Mean±SD [1]	Control (n:197) Mean±SD	p [2]
WBC [3] (10^3 / µL)	6.7 ± 2.4	10 ± 4.3	< 0.001
CRP [4] (mg / dL)	29.2 ± 40.0	18.9 ± 32.4	0.005
ESR [5] (mm / h)	33.9 ± 23.5	20.3 ± 14.1	< 0.001
NLR [6]	3.68 ± 3.8	2.02 ± 1.2	< 0.001
PLR [7]	140.1 ± 109.3	133.4 ± 66.3	0.468
MPV [8] (fL)	8.37 ± 1.2	8.15 ± 0.8	0.042

[1] Standard Deviation, [2] Groups were compared using the Student's t-test., [3] White Blood Count, [4] C-Reactive Protein, [5] Erythrocyte Sedimentation Rate, [6] Neutrophil lymphocyte Ratio, [7] Platelet Lymphocyte Ratio, [8] Mean Platelet Volume, Statistical significance level of p < 0.05 was taken.

Table 2. WBC, CRP, ESR, NLR, PLR and, MPV mean values in different brucellosis SAT.

	1 / 160	1 / 320	1 / 640	1 / 1280	>1/1280	r [1]	p
WBC [2] (10^3 / µL)	7020	6837	9510	6338	6400	-0.237	< 0.001
CRP [3] (mg / dL)	23.1	19.1	27.3	33	35.2	0.176	< 0.001
ESR [4] (mm / h)	32.4	28	31.7	34.9	37	0.323	< 0.001
NLR [5]	1.2	5.1	1.7	5.2	4.1	0.326	< 0.001
PLR [6]	145.4	135.1	155.6	126.4	140	0.025	0.626
MPV [7] (fL)	8.3	8.4	8.5	8.5	8.5	0.135	0.007

[1] Groups were compared using Pearson corelation test, [2] White Blood Count, [3] C-Reactive Protein, [4] Erythrocyte Sedimentation Rate, [5] Neutrophil lymphocyte Ratio, [6] Platelet Lymphocyte Ratio, [7] Mean Platelet Volume, Statistical significance level of p < 0.05 was taken.

Discussion

Brucellosis is the most common zoonosis in the world. It is commonly seen in developing countries and causes economic loss. It is a disease that causes a major public health problem. In our country, despite the high morbidity of brucellosis mortality is low [3,7].

There are different data in the literature between brucellosis and gender distribution. In the study by Aktar et al. [8] 53.1% of the cases were male and 46.9% were female. In another study by Olt et al. [9] 62.5% of the cases were male and 37.5% were female. Unlike the literature, our study showed that brucellosis was higher in women. This is thought to be related to the fact that women in our region are more interested in livestock.

The disease is seen in almost all age groups, but it is mostly associated with young adults and middle-aged people. The incidence is lower in children and elderly people. Brucellosis is more common in the 15-35 age group, especially in the endemic countries [10]. In a study by Buzgan et al. [3] the mean age of the patients was 33.7 ± 16.4 years. The average age of the patients was found to be 45.8 ± 15.6 years in the study done by Savaş et al. [11], 37.0 ± 15 years in the study done in Iran, and 33 years in another study done in Kuwait [12,13]. In our study, it was found as 49.6 ± 19.1 years.

WBC, CRP, and ESR are important parameters when considering the diagnosis of brucellosis. In many studies, these markers were frequently evaluated. In a study by Buzgan et al. [3], leukocytosis was found in 9% of cases and leukopenia in 10.9% of cases. In the same study, 58.4% of CRP positivity and 31.7% of patients with ESR values of >20mm/h were found. In a study conducted in Iran, it was determined that 3% of the cases were leukopenia and 12.2% were leukocytosis [12]. It has also been shown that CRP positivity (> 6 mg / L) was 59.1% and ESR values >20 mm / h was 77.8% [12]. In another study by Colmenero et al. [14] in Spain, a significant proportion of cases (28.7%) were found leukopenia (WBC < 4.5x 109 / L) and 66.8% of cases increased ESR values (> 20 mm / h). In our study, leukopenia (WBC < 4000 / μL) was found to be 5.1%, leukocytosis (WBC > 10000 /μL) 20.3%, CRP positivity (> 6 mg / dL) 59.4% and ESR > 20 mm / h 56.3%.

NLR is obtained from a whole blood count. NLR increases in inflammatory conditions and this increase is regarded as a marker of systemic inflammation [15]. Platelet plays an active role in the inflammatory process and regulates the immune system [16]. In a study by Aktar et al. [8], NLR and PLR values of patients with brucella arthritis were compared to the healthy control group. Both NLR and PLR values were statistically significantly higher than control group (p < 0.001, p < 0.001, respectively). In another study, it was determined that NLR values were significantly higher in the brucellosis group than the control group (p = 0.032), but there was no significant difference between PLR values (p = 0.853) [17]. In a study by Olt et al. [9], there was no statistically significant difference between the brucellosis group and the control group in terms of PLR (p = 0.93). In our study, it was found that the NLR values were higher in the brucellosis group than the control group (p < 0.001). And there was positive correlation between NLR and SAT titer (r = 0.326, p < 0.001). There was no significant difference between the PLR values in the groups similar to the literature.

Mean platelet volume indicates platelet size and activity. It is also used as a marker of platelet dysfunction. Increased MPV level is associated with thrombotic disorders and endothelial dysfunction [17,18]. MPV and brucellosis have been evaluated together and different results have been observed. In the study by Okan et al. [16], it was found that MPV in brucellosis group was statistically significantly lower than control group. In the study by Aktar et al. [8], MPV values were significantly higher in the brucellosis group than in the control group (p = 0.026). In the study by Togan et al. [19], MPV was found to be insignificant (p = 0.897) in a total of 250 patients with brucellosis. The results obtained in our study were similar to study of Aktar and his friends. There was significant positive correlation between MPV and SAT titer (r = 0,135, p = 0,007)

In this manuscript, the cases of brucellosis have not been investigated with staging such as acute, subacute and chronic. This is the limitation of our study.

In the initial diagnosis of brucellosis, inflammatory markers such as CRP, ESR, and WBC are also examined with SAT. In addition to these markers, NLR and MPV have also been shown to be important markers that can be used in the first diagnosis of brucellosis.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:
Nazik S, Şahin AR, Ateş S. Brucellosis and inflammatory markers: data from south-east province of Turkey. J Clin Anal Med 2018;9(6): 578-81.